1957-1958

THE GRADUATE SCHOOL

CLEMSON

New Series, Vol. XXXII June 1957 Number 3

THE CLEMSON AGRICULTURAL COLLEGE

RECORD

ANNOUNCEMENTS OF THE GRADUATE SCHOOL FOR 1957-1958

Published quarterly by The Clemson Agricultural College, Clemson, South Carolina. Entered as second-class matter April 25, 1905, at the Post Office, at Clemson, South Carolina, under the Act of July 16, 1894, now superseded by the Act of August 24, 1912.

CHECK LIST ON GRADUATE SCHOOL PROCEDURES

The final responsibility for following Graduate School procedures rests with the graduate students. Advisers should see that students are aware of this and that they understand these basic policies. Special problems may of course be referred to the Graduate School Office.

After admission the graduate student should be especially careful to follow this check list:

1. Submit **Plan for Graduate Study** (G. S. Form 2) not later than thirty days from initial registration. (See page 12.)

2. If necessary submit request for **changes** in Plan for Graduate Study. (See page 13.)

3. Satisfy any **prescribed foreign language examination** and other **qualifying examinations** prerequisite to admission to candidacy. (See page 14).

4. **Apply for candidacy to degree** (G. S. Form 4) after completing one half the prescribed residence and course work and after passing any prescribed qualifying examinations. (See page 13.)

5. Place **formal order for diploma** with the Registrar and pay **diploma fee** two months ahead of graduation. (See page 14).

6. Submit **completed thesis** to advisory committee chairman and arrange for **final examination** by the advisory committee. (See page 13.)

7. Submit **abstract** and **approved thesis** to the Dean of the Graduate School and pay **binding fee** to the Bursar. (See page 14.)

TABLE OF CONTENTS

COLLEGE CALENDAR

SUMMER TERM 1957

Matriculation, new students	June 10
Matriculation and registration	June 11
Classes begin	June 12
Independence Day holiday	July 4
Examinations	August 7, 8

SESSION 1957-1958

Matriculation, new students	September 5
Registration, new students	September 9
Matriculation and registration, former students	September 9, 10
Classes begin	September 11
Last day to add a subject	September 24
Last day to drop a subject without a penalty	October 8
State Fair holidays begin at 12 noon	October 23
Classes resumed	October 28
Thanksgiving holidays begin at 12 noon	November 27
Classes resumed	December 2
Christmas holidays begin at 12 noon	December 19
Classes resumed	January 3
End of first semester	January 25
Matriculation, new students	January 27
Registration, new students	January 29
Matriculation and registration, former students	January 30
Classes begin	January 31
Last day to add a subject	February 13
Last day to drop a subject without penalty	February 27
Easter holidays begin at 12 noon	April 3
Classes resumed	April 8
Commencement	June 1

PERSONNEL

ADMINISTRATIVE OFFICERS

Robert Franklin Poole, Ph.D., D.Sc., LL.D., Litt.D.
President

Francis Marion Kinard, A.M., Litt.D.
Dean of the College and Dean of Graduate School
Walter Thompson Cox, B.S.

Dean of Student Affairs
Melford A. Wilson, B.S
Comptroller

Robert Cook Edwards, B.S.
Vice-President for Development

Milton Dyer Farrar, Ph.D.
Dean of Agriculture

Jess Willard Jones, Ph.D.
Director of Agricultural Teaching

Howard Louis Hunter, Ph.D.
Dean, School of Arts and Sciences

James Hagood Sams, Jr., Ph.D.
Dean, School of Engineering

Hugh Monroe Brown, Ph.D.
Dean, School of Textiles

John Wallace Gordan Gourlay, A.M.L.S.
Director of the Library

Kenneth Notley Vickery, B.S.
Registrar

GRADUATE COMMITTEE

1956-1957

Francis Marion Kinard, Dean

James Pendleton Brewster
James Clinton Cook, Jr.
James Harvey Hobson
Willis Alonzo King
James Horace Langston
Charles Edward Littlejohn
Hubert Judson Webb
Jack Kenny Williams

GENERAL INFORMATION

INTRODUCTION

Clemson is a land-grant college, a state institution, and one of the A. and M. colleges which emphasize agriculture and mechanical industries. Clemson is fully accredited by the Southern Association of Colleges and Secondary Schools. The twenty-eight curriculums under the Schools of Agriculture, Arts and Sciences, Engineering, and Textiles form a background of training for the hundreds of occupations which Clemson graduates enter.

The Graduate School is not a separate division of the College as are the other schools. Rather the Graduate School exists to formulate policies and standards and to unify administrative procedures concerning graduate work. The Graduate School initiates recommendations for the awarding of earned graduate degrees.

The essential aims of graduate programs at Clemson are to provide comprehensive training in special fields, to offer instruction in the methods of independent investigation, and to foster the spirit of research scholarship.

EXPENSES

Full-time Students. The 1956-57 tuition and fees for a full-time graduate student are $129.40 per semester for a South Carolina student and $229.40 per semester for an out-of-state student. The fees included in these charges are matriculation, laboratory, class maintenance, medical, and student activity. The thesis binding fee, the diploma fee, and the fee for cap and gown rental are not included. A student living in college dormitories is charged $140.95 per semester for room, board, and laundry.

Part-time Students. The 1956-57 tuition costs to part-time graduate students vary according to the amount of work scheduled as follows:

	S. C. Student	Out-of-State
1/4 time student (1-5 credits)	$28.70	$ 53.70
1/2 time students (6-8 credits)	55.90	105.90
3/4 time students (9-11 credits)	83.10	158.10

These charges include matriculation, laboratory, and class maintenance fees. Part-time students do not pay medical fees. A part-

time student taking six or more credits is given the opportunity at the time of matriculation of paying a $9.10 student activities fee.

FINANCIAL AID FOR GRADUATE STUDY

Both research and teaching assistantships are available to outstanding graduate students. Teaching assistantships are normally awarded for the academic year. Research assistantships may be granted for periods of twelve months. Final selection for these assistantships will be on a competitive basis. An interested student should apply to the department in which he desires to study.

A number of graduate fellowships are also available. Among them are the following:

The Alexander P. and Lydia Anderson Fellowship. Income from a fund donated by Mr. and Mrs. Anderson is available annually for one or more awards to graduate students in the Biological Sciences, including Bacteriology and Entomology.

The Celanese Fellowship. A $1,500.00 award plus tuition fees and research materials is available annually to an outstanding student for graduate research in Textile Chemistry.

The Dow Corning Fellowship. A $1,500.00 award plus tuition, fees and research supplies is available annually to an outstanding student for graduate research in Textile Chemistry.

The Edward Orton, Jr. Fellowship. A $1,200.00 award plus supplies is available annually to an outstanding student for graduate research in Ceramic Engineering.

The Godfrey L. Cabot Fellowship. A$1,500.00 award ($2,400.00 if married) is available annually to an outstanding student for graduate research in Ceramic Engineering.

The Zonolite Fellowship. A $1,500.00 award is available annually to an outstanding graduate student for fundamental research in Ceramic Engineering.

Recipients of fellowship awards are selected by the academic departments concerned. Further information may be obtained from department heads.

EDUCATIONAL BENEFITS FOR VETERANS

Eligible veterans of the armed services may qualify for financial aid in graduate study. Forms for filing applications for assistance are provided by the Veteran's Administration.

LIBRARY

The Library Building houses the main Library, the Agricultural Reference Department and the Browsing Room. In addition, several departments of the College maintain departmental libraries in their own buildings.

The main Library collection consists of some 155,000 bound volumes of books, periodicals and government publications. Added to these are thousands of unbound federal and state documents, agricultural and engineering experiment station and extension publications, and more than 12,000 pamphlets and clippings relating to Clemson College and South Carolina.

The Library is essentially a consolidation of special libraries: agriculture and the biological sciences, science and technology, and carefully selected smaller collections in the social sciences and humanities. The Library currently receives 1,732 periodical titles and more than 280 other continuations. Of these, about 240 are foreign publications. The Library receives forty newspapers.

HOUSING FACILITIES

Dormitories. There are six dormitories for men, one housing approximately 2,000 students and the others 100 each. The room fees ($86.00 per semester) are the same for all dormitories. Students are housed two per room, and room assignment is made insofar as possible in accordance with each student's preference.

All students living in the College dormitories must take their meals in the Dining Hall.

At the present time no dormitory facilities are available for women students, who must find housing facilities in the town of Clemson or surrounding areas.

Family Housing. Two housing projects are operated by the College for married students. The Veterans Village consists of 287

two-bedroom units. The monthly rental ranges from $18.00 to $27.00 and includes water and ground maintenance. Each unit is metered for electricity and bills are rendered monthly to tenants for electricity consumed.

The New Brick Apartments consist of fifty units with two bedrooms each. The monthly rental is $31.00 to $34.00 per month, which includes water, 300 kwh electricity per billing period, and ground maintenance.

Applications for married student housing should be made to the College Housing Project Office which assigns units on the basis of the date of application.

STUDENT HEALTH SERVICE

The Director of Student Health is in charge of the student health services at Clemson College. During clinic hours students may consult the Director of Student Health, and those who are admitted to the infirmary are attended by experienced personnel. In cases of necessity students are allowed to consult the Director of Student Health at any time, or to send for him in an emergency.

The medical fee paid by students is intended to cover all ordinary cases of sickness and their treatment. It is not intended to cover fees of doctors or specialists called into consultation, or the costs of operations, special nurses, ambulance service, and medical or surgical attentions performed away from the College. The right of the Director of Student Health Service, with the approval of the President of the College, to incur in behalf of any student under his care any of these extra services is hereby expressly reserved. Clemson College does not assume any responsibility for accidents that happen away from the College.

STUDENT PLACEMENT

An office of student placement is maintained by the College in the Student Center. This office endeavors to assist all qualified students and former students in selecting suitable vocations, in arranging part-time work, and in obtaining career employment.

ORGANIZATION AND GOVERNMENT

ADMINISTRATIVE ORGANIZATION

The government of the College is vested in a Board of Trustees. In accord with the Thomas G. Clemson Will the Board includes six members elected by the Legislature and a self-perpetuating group of seven members. The function of the Board is legislative and not executive. The Board determines the general policy of the College and directs the expenditure of its funds.

The President of the College is the chief executive and administrative officer and is appointed by the Board of Trustees.

The College is divided into schools of Agriculture, Arts and Sciences, Engineering, and Textiles. A dean is at the head of each school. The schools are comprised of departments and each department is in the charge of a professor who acts as its head. The academic programs of the several schools and departments are coordinated under the jurisdiction of the Dean of the College, who is also Dean of the Graduate School and chairman of the faculty Committee on Graduate Work. The functions of this Committe are

> "To advise the Dean of the Graduate School on all standards, policies and, procedures for graduate work and to recommend candidates for graduate degrees to the General Faculty for graduation."

COLLEGE REGULATIONS

The College and its various schools and departments reserve the right to change the rules regulating the admission to, instruction in and graduation from the College or its various schools, and any other regulations affecting the student body. Such regulations become effective whenever the proper authorities may determine and apply not only to prospective students but also to those who may at such time be matriculated in the College. The College also reserves the right to withdraw courses, to change instructors or to change fees at any time.

GRADUATE DEGREES AND CURRICULUMS

Courses and Degrees. Courses are offered leading to the degree of Master of Science in the following fields: Agricultural Eco-

nomics, Agricultural Education, Agricultural Engineering, Agronomy, Animal Husbandry, Bacteriology, Ceramic Engineering, Chemistry, Civil Engineering, Dairy, Education, Electrical Engineering, Entomology, Horticulture, Industrial Education, Mathematics, Mechanical Engineering, Physics, Plant Pathology, Textile Chemistry, and Zoology.

The degree of Master of Agricultural Education is offered by the Department of Agricultural Education.

The degree of Doctor of Philosophy is offered in Plant Pathology and Entomology.

A list of courses acceptable for graduate credit in major and minor fields is found elsewhere in this Bulletin. Courses primarily for graduate credit are those of the 500 series. Certain courses of the 300 and 400 series are acceptable for graduate credit in accord with conditions outlined under "course work required." The names and catalog numbers of these 300 and 400 series courses are listed in this Bulletin. Complete descriptions of these courses can be found in the General College Catalog which may be obtained from the Registrar.

REGULATIONS AND PROCEDURES

Admission. Before admission to the Graduate School a student must have the Bachelor's degree from an institution with a scholastic rating satisfactory to the College, must have made a satisfactory score on the Graduate Record Examination or the South Carolina Entrance Examination, and must have the approval of the Head of the Department in which he plans to do his major work. For unconditional admission to the Graduate School the applicant must have an average undergraduate grade of B or better in the major field and should be in the upper half of his class. If the previous scholastic training is not considered adequate, the student may be required to remove the deficiency by doing supplementary work and lengthening the time required to obtain the degree.

Students desiring to enroll in the Graduate School must make application on Graduate School Form 1. This form may be obtain-

ed from the Director of Admissions. The application, accompanied by a transcript of previous college work and by such written recommendations as are necessary in support of the application, is returned to the Director of Admissions. The Registrar will not permit enrollment in courses of the 500 series until the student has been officially admitted to the Graduate School.

Eligibility of College Employees to Pursue Graduate Study. With the approval of his Dean or Director, a qualified employee of Clemson College may pursue graduate work for credit. However, no member of the faculty or staff who has a rank higher than Instructor or its equivalent may be considered as a candidate for advanced degree at this institution.

Maximum Credit Load. The maximum load for students who are devoting all of their time to graduate work is fifteen credit hours per semester, or one credit hour per week during the Summer School. Persons who are employed by the College on a full-time basis may not carry more than six semester credits per semester. The maximum graduate load for students devoting part-time to staff duties or research work will be determined by their total work load. The work load is the number of credit hours taken or taught multiplied by three plus the actual number of hours per week spent in performing other staff duties or research work. For students devoting part-time to graduate study, the total work load per week for the first semester of graduate enrollment must not exceed 48 hours. After the first semester, a part-time student whose work is superior may, with the approval of the head of his department and the Dean of the Graduate School, schedule a work load in excess of 48 hours but not in excess of 60 hours.

In the event of scheduling difficulties, a part-time student may, with the approval of the group named above, exceed the limits specified by not more than three work load hours for any one semester, provided the average work load for the academic year does not exceed these limits.

Filing of Preliminary Study Plan. Graduate students, within one month after registering for graduate credit, must file with the Dean of the Graduate School a preliminary study plan. The form for this plan (G. S. Form 2) may be obtained from the student's de-

partment head or from the Graduate School office. G. S. Form 2 may be filed in advance of initial registration. Changes in the student's preliminary plan of study may be requested at any time. Proposals for change should originate in consultation between the student and his major adviser, be approved in writing by the heads of the student's major and minor departments, and forwarded in quadruplicate to the Dean of the Graduate School.

Admission to Candidacy for a Graduate Degree. Admission to the Graduate School does not qualify a student as a candidate for an advanced degree. Such candidacy depends on the acceptance by the Dean of the Graduate School of a written request for admission to candidacy. This request (G.S. Form 4) should be filed by the student once he has completed at least one-half his prescribed graduate residence and course work, (research courses excepted), and has successfully undertaken whatever preliminary or qualifying examinations are required. This request for admission to candidacy must list each of the major and minor subjects to be offered for the degree and must contain the title of the proposed thesis or research report. The request should bear the signed approval of the heads of the major and minor departments concerned. A student must be admitted to candidacy for a Master's degree at least four months, and for a Doctor of Philosophy degree at least nine months, before the date on which the degree is expected.

The Student's Advisory Committee. Admission to candidacy for a graduate degree will precede the appointing of the student's advisory committee by the Dean of the Graduate School. This committee will supervise the student's research and his thesis or research report. The committee will also administer the final examination and other special examinations which may be prescribed. The recommendation to the Graduate School of a student for an advanced degree must originate with his advisory committee.

The Thesis and Thesis Abstract. Each candidate for an advanced degree (except that of Master of Agricultural Education) is required to prepare a thesis under the direction of a major adviser. Six hours of credit are allowed for the research leading to the required Master's thesis.

Three typewritten copies of the thesis (the original copy and the first and second carbons) must be presented to the chairman of the student's advisory committee in sufficient time for the chairman to arrange for a final examination to be held at least two weeks prior to the date on which the degree is expected. A doctoral thesis must be completed and accepted by the student's advisory committee at least two weeks prior to the final examination. The three copies of the thesis must be submitted to the Dean of the Graduate School at least one week prior to the date on which the degree is conferred. A binding fee of $9.00 must be paid to the Bursar and the Bursar's receipt submitted to the Graduate School office at the time the thesis is submitted. If the student desires, he may have an additional copy of his thesis bound for himself at a cost of $3.00. The responsibility for placing the thesis in proper final form rests with the student and the chairman of his advisory committee. A statement of special procedures for writing a thesis at Clemson College may be obtained from the Graduate School office.

The student will prepare an abstract of his thesis which must be submitted in triplicate with the thesis to the Dean of the Graduate School. Ordinarily this abstract should not exceed five hundred words in length. It should be written and edited in such a way that it will be suitable for publication. Each copy of the abstract should carry the signed approval of the chairman of the student's advisory committee.

Language Examinations. Certain advanced degrees require that the student demonstrate a reading knowledge of one or more foreign languages. Language examinations are given by the Language Department each semester at a stated time as announced by the Dean of the Graduate School.

The language examinations are taken from sources supplied to the Language Department by the student's major department. The major department supplies at least one book in the student's field, from which the Language Department chooses the section to be translated. Examinations are confined to reading knowledge with dictionary and are "time limit" in character.

Application for a Diploma. A formal application for a diploma must be placed by the student with the Registrar at least two

months prior to the date on which the degree is to be conferred. At this time the diploma fee of $3.00 (or $6.50 if a diploma case is desired) must be paid. Arrangements should be made at this time for cap and gown rental. The student, unless specifically excused by the College President, must attend commencement exercises in order to obtain his degree.

ADDITIONAL REQUIREMENTS FOR MASTER OF SCIENCE DEGREE

To receive the Master of Science degree a student must spend the equivalent of at least one academic year in graduate residence at the College.* No graduate credit will be allowed for any course completed in less than six weeks. All course work which is to be credited toward a Master of Science degree must have been completed not more than six calendar years prior to the date on which the degree is to be awarded; except that when approved by the student's department head and the Dean of the Graduate School, as many as six semester hours of course work completed outside the six-year limit of time may be validated by written re-examination. Such examination will be under the direction of the department regularly offering the course or courses for which the student seeks validation. Course work completed outside the six-year limit of time at an institution other than Clemson College may not be transferred to Clemson for graduate credit.

Course Work Required. In addition to such supplementary or supporting courses as may be required, the work will consist of a minimum of thirty semester hours, including six semester hours of research which will provide the basis for the required thesis. Of the remaining twenty-four semester hours, at least twelve hours must come from courses numbered 500 or above. A minimum of twelve hours must be in the student's major field and a minimum of six hours in one minor. To receive graduate credit for a course in the 300 or 400 series a student must attain a grade of B or better. Graduate credit may be received for a grade of C on 500 series courses; however, the grade on a credit hour basis for all 500 series

*An academic year in graduate residence is defined as a minimum of two regular semesters (or summer equivalent) of enrollment, and the successful completion of a minimum of eighteen hours of course work, exclusive of research.

courses must average B or better before the student can become eligible for an advanced degree. As a rule it is not permissible to select a minor in the same field as the major. No student shall receive both graduate and undergraduate credit for the same course.

Transferred Credits. As many as six semester hours of credit obtained in a different but recognized institution may be transferred and credited to the Master's degree, provided that the work was of graduate character. No credit toward graduate degrees may be obtained by correspondence or extension study.

Language Requirement. A reading knowledge of one modern language is required by some departments. Procedures concerning language examinations are given elsewhere in this Bulletin.

Final Examination. Each candidate for a Master's degree, after the completion of the required thesis and at least two weeks before the degree is to be awarded must pass such examination as may be required by the student's advisory committee. The examination, which may be oral or written, will ascertain the general knowledge of the candidate with particular reference to the major and minor subjects and the thesis or research report. Included with those members of the faculty and staff invited to attend the examination will be the Dean of the Graduate School and members of the faculty Committee on Graduate Work. Immediately after the examination the examining committee will notify the Dean of the Graduate School of its findings. This notification will be made on Graduate School Form 7.

ADDITIONAL REQUIREMENTS FOR THE MASTER OF AGRICULTURAL EDUCATION DEGREE

To receive the Master of Agricultural Education degree a student must fulfill those requirements relating to residence, preliminary study plan, transferred credits, and comprehensive examinations which are in effect for other Master's degrees. No graduate credit will be allowed for any course completed in less than six weeks and all course work which is to be credited toward the advanced degree in Agricultural Education must have been completed not more than six calendar years prior to the date on which the degree is to be awarded; except that as many as six semester hours of

course work completed outside the six-year limit of time may be validated by written examination.

Course Work Required. In addition to such supplementary or supporting courses as may be required, the work for the Master of Agricultural Education degree shall consist of a minimum of thirty-three semester hours, at least eighteen of which shall be earned in courses numbered above 500. The course requirements will be distributed as follows:

1. Twelve hours shall be in Education, as a major.

2. Twelve hours shall be in technical agriculture. Six of these hours must be in the same field and will be considered as a minor.

3. Three hours shall be in a discipline outside the field of the major.

4. Three hours shall be in agricultural research techniques and three in experimental statistics.

ADDITIONAL REQUIREMENTS FOR DOCTOR OF PHILOSOPHY DEGREE

Work leading to the Doctor of Philosophy degree is planned in such a way as to give the student a comprehensive knowledge of his fields of specialization and a mastery of the methods of research. The degree is not awarded solely on the basis of course work completed, residence or other routine requirements. The final basis for granting the degree will be the student's grasp of the subject matter of a broad field of study, his competency to plan and conduct research, and his ability to express himself adequately and professionally in oral and written language.

Residence Requirements. To receive the Doctor of Philosophy degree the student must spend the equivalent of at least three academic years in full residence as a graduate student. At least one academic year must be in continuous resident study at this institution. The definition of an academic year in residence is found elsewhere in this Bulletin.

Time Limit. All work for a Doctor of Philosophy degree must be completed within a period of seven years. If the student begins his doctoral program after receiving the Master's degree, all work

above the Master's level must be completed within a six year period.

Language Requirement. A reading knowledge of both French and German is required of all candidates for the doctorate; except that other languages may be substituted in cases where it is demonstrated that they will be of more value in the particular specialty of the student. Such substitutions must be approved by the student's department head and by the Dean of the Graduate School. All language requirements must have been satisfied prior to the student's preliminary or qualifying examination and prior to his admission to candidacy for the degree.

Selection of Major and Minor Fields. Not later than the time of initial registration in the Graduate School, the student shall designate in writing to the Dean of the Graduate School his selection of a major field and two minor fields of study. The heads of these major and minor departments, with the assistance of those professors who may be designated, will then advise the student as to his program of course work and will arrange for his preliminary examinations prior to admission to candidacy for the degree.

Qualifying Examinations Before Admission to Candidacy. The student must undertake such preliminary or qualifying examinations as may be prescribed before he applies for admission to candidacy for his degree. These examinations may be written, oral, or a combination of both. The function of the examination is to obtain objective evidence of an adequate intellectual mastery of the student's areas of major and minor specialization.

The student's performance on these examinations will determine whether or not the heads of his major and minor departments shall recommend acceptance of his application for admission to candidacy. Immediately after the examination the examining committee will notify the Dean of the Graduate School of its findings.

Should the student fail to pass his preliminary examinations he may be given the opportunity to undergo the examinations a second time. A second failure shall result in the student being declared ineligible for the Doctor of Philosophy degree at Clemson College.

Final Doctoral Oral Examination. The candidate for the Doctor of Philosophy degree must pass a final oral examination at least two weeks prior to the time of the convocation at which he plans to obtain the degree. The examination will be conducted by the student's advisory committee, and all faculty members will be invited to participate. The Graduate School Office will be notified of the time and place of the examination at least ten day prior to the time scheduled.

This final examination demands a broad and penetrating interpretation by the student of his research project and conclusions. It may include examination of the student in his major and minor fields of specialization.

DESCRIPTION OF COURSES

AGRICULTURAL ECONOMICS

Ag Ec 352—PUBLIC FINANCE—3 cr. (3 and 0)

Ag Ec 357—CONSERVATION OF NATURAL RESOURCES—3 cr. (3 and 0)

Ag Ec 401—STATISTICS—3 cr. (2 and 3)

Ag Ec 451—AGRICULTURAL COOPERATION—2 cr. (2 and 0)

Ag Ec 452—AGRICULTURAL POLICY—3 cr. (3 and 0)

Ag Ec 456—PRICES—3 cr. (3 and 0)

Ag Ec 460—AGRICULTURAL FINANCE—2 cr. (2 and 0)

Ag Ec 462—APPLIED STATISTICS—3 cr. (2 and 3)

Ag Ec 501—ADVANCED FARM MANAGEMENT—3 cr. (2 and 3)
Study and appraisal of methods of assembling and analyzing information concerning the business of farming. **Prerequisites:** Ag Ec 302 and Ag Ec 401.

Ag Ec 503—LAND ECONOMICS—3 cr. (3 and 0)
A study of the characteristics of land and its utilization in relation to population and public policies. **Prerequisites:** Permission of instructor.

Ag Ec 505—ECONOMIC THEORY—3 cr. (3 and 0)
A review of economic principles, a study of the use of theory in the analysis of economic problems, and an appraisal of recent developments in capitalistic economic theory. **Prerequisite:** Permission of instructor.

Ag Ec 507—AGRICULTURAL MARKETING PROBLEMS—3 cr. (3 and 0)
A study of special problems involved in research and marketing southern fruits, vegetables, livestock and livestock products. Students will undertake individual assignments in the field of their interest. **Prerequisite:** Ag Ec 309 or permission of instructor.

Ag Ec 512—EXPERIMENTAL DESIGNS—3 cr. (3 and 0)
An examination of the ways to plan and conduct comparative experiments so they will provide, efficiently, specific answers to scientific questions under investigation. **Prerequisite:** Ag Ec 401 or permission of instructor.

Ag Ec 514—CONTEMPORARY ECONOMIC PROBLEMS—3 cr. (3 and 0)
A critical review of the nature of contemporary economic problems, the background out of which they developed, the remedies which have been applied, and possible alternatives. (Special emphasis will be given to problems relating to agriculture and rural life.) **Prerequisite:** Permission of instructor.

Ag Ec 591—RESEARCH—3 cr.
Study of scientific methods and their application to research in agricultural economics.

Ag Ec 592—RESEARCH—3 cr.
Continuation of Ag Ec 591 (thesis)

AGRICULTURAL EDUCATION

Students desiring to pursue graduate work with a major in the field of Agricultural Education are expected to have as prerequisite enough work in this field to qualify them for a Class III teacher's certificate under the rules of the State Board of Education. Students desiring to minor in this field or to elect one or more courses for graduate credit must have the approval of the head of the department in which the work is offered and of the Dean of the Graduate School. Students electing courses numbered less than 500 will schedule their work along with undergraduate students but will be expected to complete such additional assignments as the instructors may require.

Ag Ed 401—METHODS IN AGRICULTURAL EDUCATION—3 cr. (3 and 0)

Ag Ed 463—ADVANCED CONSERVATION EDUCATION—3 cr. (2 and 0)

Ag Ed 501—RECENT DEVELOPMENTS IN THE TECHNOLOGY OF AGRICULTURE—3 cr. (2 and 3)
This course will include a thorough analysis and appraisal of the experimental findings and successful farming practices developed during World War II and in the post war period in the various fields of agriculture. It is designed to bring agricultural workers "up-to-date" in their knowledge and thinking in agricultural technology to the end that they may render more efficient service to rural people. Emphasis in this course will be on crops and mechanization.

Ag Ed 502—RECENT DEVELOPMENTS IN THE TECHNOLOGY OF AGRICULTURE—3 cr. (2 and 3)
A continuation of Ed 501 with emphasis in developments in animal sciences and agricultural economics.

Ag Ed 504—SPECIAL PROBLEMS IN TEACHING VOCATIONAL AGRICULTURE—3 cr. (2 and 3)
This course will be devoted to the analysis, exploration and development of plans for the solution of some of the current problems being encountered by teachers of Vocational Agriculture. Planning adequate programs of work, planning needed buildings and equipment, securing and training assistant and/or special teachers, promoting cooperative efforts, and similar problems will be chosen or assigned for individual and group effort.

Ag Ed 515—ADVANCED METHODS OF TEACHING FARM MECHANICS 3 cr. (2 and 3)
Organization of teaching units, methods of determining the content of the

course, securing and equipping the shop, teaching farm mechanics and other shop problems which are involved in teaching farm people are considered in this course. School shop management, planning lessons, and demonstrations are also given major emphasis.

Ag Ed 520—TEACHING YOUNG FARMERS—3 cr. (3 and 0)

The purpose of this course is to provide training for young farmers establishing themselves in the business of farming. Emphasis will be placed upon organization, cooperation and private enterprise. Buying and selling of various types of markets will be covered. The uses of governmental facilities for handling goods, credit, communications, and power will be studied. Conservation as a community and individual enterprise will be discussed. Limited number of field trips will be considered. How young farmers may cooperate with younger F.F.A., 4-H Club, and older farmers will be stressed.

Ag Ed 525—SUPERVISION OF STUDENT TEACHING—3 cr. (3 and 0)

In this course major emphasis is placed upon the following: (1) developing a point of view or philosophy of teacher education; (2) analyzing the present teacher training program in South Carolina, to discover problem situations that may be used as a basis for teacher education programs; (3) determining the relative emphasis for each teacher to place upon the solution of the problems in the teacher-education program; (4) projecting plans for an apprentice training program, and (5) supervising apprentice training in the state.

Ag Ed 591—INTRODUCTION TO RESEARCH IN EDUCATION—3 cr. (3 and 0)

The course attempts to familiarize the graduate student in education with the methods and techniques common to educational research, and to give training and experience in evaluating research in education. Studies and theses of various types will be examined and summarized.

Ag Ed 592—RESEARCH IN AGRICULTURAL EDUCATION—3 cr. (3 and 0)

A continuation of Ed 591. The student will conduct individual research on some problem in agricultural education. The student may submit a report on this research, which if acceptable to his examining committee will meet the thesis requirement.

AGRICULTURAL ENGINEERING

Ag En 352—FARM POWER—3 cr. (2 and 3)

Ag En 360—FARM AND HOME UTILITIES—3 cr. (2 and 3)

Ag En 401—SOIL AND WATER CONSERVATION ENGINEERING—3 cr. (2 and 3)

Ag En 402—DRAINAGE AND IRRIGATION—3 cr. (2 and 3)

Ag En 451—FARM STRUCTURES—3 cr. (2 and 3)

Ag En 452—ADVANCED FARM STRUCTURES—3 cr. (2 and 3)

Ag En 481—FUNDAMENTALS OF GIN ENGINEERING—3 cr. (2 and 3)

Ag En 501—SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING —3 cr. (3 and 0)

Each student will select a subject pertaining to his particular interest or major field of study in Agricultural Engineering. Library and/or laboratory research will be conducted and a technical report will be written. The subject may be selected from one of the following: (a) Power and Machinery, (b) Soil and Water, (c) Farm Structures, or (d) Rural Electrification. **Prerequisite:** Graduate standing and permission of instructor.

Ag En 504—ENGINEERING APPLICATIONS TO AGRICULTURE PROCESSING—3 cr. (2 and 3)

An advanced course dealing with the unit operation involved in the processing of Agricultural products. The application of engineering principles and instrumentation to size reduction, cleaning and grading, mixing, materials handling, work simplifications, dehydrating and drying, refrigeration, storage, and related subjects. **Prerequisite:** Permission of instructor.

Ag En 511—DESIGN OF FARM MACHINERY—3 cr. (3 and 0)

A study of the design and selection of the mechanical units of machines will be made with emphasis on their application to the agricultural implement field. **Prerequisite:** Mech 304 and Ag En 406.

Ag En 512—DESIGN OF FARM MACHINERY—3 cr. (2 and 3)

Problems in agricultural implement design will be chosen to coordinate the design of functional units of farm machines with the selection of machine members. **Prerequisite:** Ag En 511.

Ag En 522—ADVANCED DRAINAGE & IRRIGATION ENGINEERING—3 cr. (3 and 0)

A study of theory and principles of drainage, irrigation and water storage. Principal topics include theory and application of flow of water through soil in unsaturated and saturated states, flow nets and seepage forces, and the fundamentals of engineering design with respect to ground water problems and soil moisture relationships. **Prerequisite:** Ag En 401, 402 or by special permission.

Ag En 582—ADVANCED GIN ENGINEERING—3 cr. (3 and 0)

Design, development, analysis and synthesis of gin machinery to meet the functional requirements necessary for processing and handling cotton in modern gin establishments. Special emphasis is placed on the problems created by the introduction of mechanical harvesters. Special problems are assigned to give the student an opportunity for independent thinking. **Prerequisite:** Mech 304 and Ag En 406 or equivalent.

Ag En 591—RESEARCH—3 cr.

Ag En 592—RESEARCH—3 cr.

AGRONOMY

Agron 301—FERTILIZERS and MANURES—3 cr. (3 and 0)

Agron 302—GENETICS—3 cr. (2 and 3)

Agron 306—FORAGE AND PASTURE CROPS—3 cr. (3 and 0)

Agron 405—PLANT BREEDING—3 cr. (2 and 3)

Agron 409—COTTON AND TOBACCO—3 cr. (3 and 0)

Agron 451—MINERAL NUTRITION OF PLANTS—2 cr. (2 and 0)

Agron 452—SOIL FERTILITY, CLASSIFICATION, AND MANAGEMENT—2 cr. (2 and 0)

Agron 455—SEMINAR—1 cr. (1 and 0)

Agron 456—SEMINAR—1 cr. (1 and 0)

Agron 501—ADVANCED NUTRITION OF CROPS—3 cr. (3 and 0)
A graduate course dealing with the relationship existing between the physical and chemical properties of the various nutrient elements and their absorption and utilization by plants.

Agron 502—ADVANCED PEDOLOGY AND SOIL CLASSIFICATION—3 cr. (3 and 0)
A graduate course dealing largely with the factors of soil formation and soil classification. A thorough study is made of such factors of soil formation as parent material, topography, climate, and organisms. Particular attention is given to the classification of Southeastern soils.

Agron 503—ADVANCED CROP PRODUCTION—3 cr. (3 and 0)
A graduate course dealing with specific problems commonly encountered in the production of crops in the Southeast. Major attention is given to the problems met with the production of cotton, bright tobacco, corn and oats.

Agron 504—ADVANCED PLANT BREEDING AND GENETICS—3 cr. (3 and 0)
A graduate course designed to acquaint the student with the best methods now employed in the production and development of superior strains of plants. Visits will be made to neighboring plant breeding establishments and their methods will be observed.

Agron 505—ADVANCED SOIL FERTILITY—3 cr. (3 and 0)
An advanced course dealing with soil conditions affecting plant growth, soil and plant relationships from the standpoint of normal growth under field conditions, and the essential principles in improving and maintaining soil fertility.

Agron 506—SPECIAL PROBLEMS—2 to 4 cr.
Original investigation of special problems in Agronomy which are not

related to a thesis but designed to provide experience and training in research. **Prerequisite:** Graduate standing and permission of instructor.

Agron 591—RESEARCH—3 cr.

Agron 592—RESEARCH—3 cr.

ANIMAL HUSBANDRY

AH 310, 314—PORK PRODUCTION—4 cr. (3 and 3)

AH 401, 403—BEEF PRODUCTION—4 cr. (3 and 3)

AH 452—ANIMAL BREEDING—3 cr. (2 and 3)

AH 453—MEATS—1 cr. (1 and 0)

AH 455—MEATS LABORATORY—2 cr. (0 and 6)

AH 502—TOPICAL PROBLEMS—1-3 cr. (1-3 and 0)
A critical study of Animal Husbandry experiments and the interpretation of their results. Intended to prepare students for positions with agricultural colleges and experiment stations and the United States Department of Agriculture.

AH 504—METHODS IN ANIMAL BREEDING—3 cr. (3 and 0)
A study of factors governing gene and zygotic frequency; systems of mating; heritabilities; genetic consequences of selection; and criteria for evaluating improvement in beef cattle, swine, and sheep.

AH 505—NUTRITION OF MEAT ANIMALS—3 cr. (3 and 0)
A course dealing with the metabolism of carbohydrates, lipids, proteins, inorganic elements, and vitamins in the nutrition of beef cattle, swine, and sheep; the nutrient requirements of meat animals with special emphasis on the properties and functions of nutrients.

AH 591—RESEARCH—3 cr.

AH 592—RESEARCH—3 cr.

ARCHITECTURE

Arch 301—ARCHITECTURAL DESIGN—4 cr. (0 and 12)

Arch 302—ARCHITECTURAL DESIGN—4 cr. (0 and 12)

Arch 307—VISUAL ARTS LAB.—1 cr. (0 and 3)

Arch 309—HISTORY OF ARCHITECTURE—3 cr. (3 and 0)

Arch 310—HISTORY OF ARCHITECTURE—3 cr. (3 and 0)

Arch 318—INTERMEDIATE CONSTRUCTION—2 cr. (0 and 6)

Arch 320—DRAWING AND COLOR—2 cr. (0 and 6)

Arch 401—ARCHITECTURAL DESIGN—6 cr. (0 and 18)

Arch 402—ARCHITECTURAL DESIGN—6 cr. (0 and 18)

Arch 406—VISUAL ARTS LAB.—1 cr. (0 and 3)

Arch 408—INDUSTRIAL DESIGN—1 cr. (0 and 3)

Arch 409—ART APPRECIATION—3 cr. (3 and 0)

Arch 411—HISTORY OF ARCHITECTURE—2 cr. (2 and 0)

Arch 412—HISTORY OF ART—3 cr. (3 and 0)

Arch 415—STRUCTURAL METHODS—2 cr. (2 and 0)

Arch 418—CONSTRUCTION—2 cr. (2 and 0)

Arch 428—WORKING DRAWINGS—3 cr. (0 and 9)

Arch 451—ARCHITECTURAL DESIGN—6 cr. (0 and 18)

Arch 461—TOWN AND REGIONAL PLANNING—3 cr. (1 and 6)

Arch 462—TOWN AND REGIONAL PLANNING—3 cr. (1 and 6)

Arch 465—ADVANCED CONSTRUCTION—2 cr. (1 and 3)

Arch 468—ADVANCED CONSTRUCTION—2 cr. (0 and 6)

Arch 471—MECHANICAL PLANT—2 cr. (1 and 3)

Arch 472—MECHANICAL PLANT—2 cr. (1 and 3)

Arch 475—ARCH. OFFICE PRACTICE—2 cr (2 and 0)

Arch 476—ARCH. OFFICE PRACTICE—2 cr. (2 and 0)

Arch 478—STRUCTURAL THESIS—6 cr. (0 and 18)

BACTERIOLOGY

Bact 301—GENERAL BACTERIOLOGY—4 cr. (3 and 3)

Bact 310—ADVANCED BACTERIOLOGY—4 cr. (2 and 6)

Bact 402—DAIRY BACTERIOLOGY—3 cr. (2 and 3)

Bact 406—SANITARY BACTERIOLOGY—4 cr. (3 and 3)

Bact 410—SOIL MICROBIOLOGY—3 cr. (2 and 3)

Bact 501—BACTERIAL TAXONOMY—3 cr. (2 and 3)

This course covers the history of determinative bacteriology, and the basic morphological, cultural, and physiological differences used in distinguishing between the various taxonomic groups of bacteria. Opportunity will be given in the laboratory to isolate and identify bacteria from natural sources. **Prerequisites:** Bact 301, 310, and organic chemistry.

Bact 502—ADVANCED BACTERIOLOGICAL TECHNIC—4 cr. (2 and 6)
A course including methods of preparing special equipment for use in the bacteriological laboratory, sterilization by filtration, isolation of viruses, immunological procedures, and the experimental infaction of animals. This course is designed to give students interested in research in the field of bacteriology experience in more advanced methods of investigation. **Prerequisites:** Bact 301, 310, and organic chemistry.

Bact 505—PHYSIOLOGY OF BACTERIA—3 cr. (2 and 3)
A study of bacterial cytology, enzymes, growth curves, respiration, aerobiosis, anaerobiosis, nutrition of bacteria and degradation of proteins, carbohydrates, and fats. **Prerequisites:** Bact 301, 310, and organic chemistry.

Bact 591—RESEARCH—3 cr.

Bact 592—RESEARCH—3 cr.

BOTANY

Bot 351—PLANT MORPHOLOGY—4 cr. (2 and 6)

Bot 352—PLANT PHYSIOLOGY—4 cr. (3 and 3)

Bot 355—HISTOLOGY—2 cr. (0 and 6)

Bot 356—TAXONOMY—3 cr. (1 and 6)

Bot 401, 403—PLANT PATHOLOGY—3 cr. (2 and 3)

Bot 451—MORPHOLOGY OF THE FUNGI—3 cr. (2 and 3)

Bot 501—METHODS OF RESEARCH IN PLANT PHYSIOLOGY—4 cr. (2 and 6)
A theoretical and practical study of methods used in investigation of physiological processes and the factors influencing those processes. Topics include sand and solution culture methods, measurement and control of soil water content, atmospheric humidity and radiant energy, and determinations of osmotic quantities, hydrogen ion concentration, and metabolic processes. **Prerequisites:** Bot 352, Chem 101, 102; Phys 201, 202, 203, 204.

Bot 502—ADVANCED MYCOLOGY—3 cr. (2 and 3)
A course designed chiefly for students majoring in plant pathology and closely allied fields. A detailed study is made of specific groups of fungi, especially those of economic importance of this region. Emphasis is placed on field collection identification, morphology, and cytology through lectures and student reports and laboratory work. **Prerequisites:** Bot 356, 451.

Bot 503—ADVANCED PLANT PATHOLOGY—4 cr. (3 and 3)
Essentially an introduction to research on plant diseases with review and recording of literature; preparation of media; isolation of single-cells of organisms in pure culture; a class study of infection and epidemiology of one fungus, one bacterial, and one virus disease; and an individual "prob-

lem" with preparation of a manuscript according to standards of a scientific journal. **Prerequisites:** Bot 401, 403.

Bot 504—PHYSIOLOGY OF PARASITISM IN PLANTS—3 cr. (3 and 0)
This course is designed to acquaint the student with the interaction of host and parasite as affected by environmental conditions and nutrition of the host. Emphasis will be given to the factors that influence infection and the development of the parasite within the host. **Prerequisites:** Bot 351, 352, 401, and 403.

Bot 505—SPECIAL PROBLEMS IN PLANT PATHOLOGY—*
Original investigation of special problems in plant pathology which are not related to a thesis but designed to provide experience and training in research. **Prerequisite:** Graduate standing and permission of instructor.

Bot 506—CHEMICAL CONTROL OF PLANT DISEASES—2 or 4 cr. (2 and 0 or 2 and 6)
An introduction to the chemicals used in the control of plant diseases, the nature of their action on fungi, their application and methods of evaluation. Laboratory facilities are available for qualified students who may wish to evaluate chemicals in respect to their effectiveness in the control of specific plant diseases. **Prerequisites:** Bot 401, 403, and organic chemistry.

Bot 591—RESEARCH—3 cr.

Bot 592—RESEARCH—3 cr.

CERAMIC ARTS

Cr Ar 301—POTTER GLAZES—3 cr. (3 and 0)

Cr Ar 401—ADVANCED POTTERY—3 cr. (2 and 3)

CERAMIC ENGINEERING

Cr En 301—THE DRYING AND FIRING OF CERAMIC PRODUCTS—4 cr. (3 and 3)

Cr En 305—THERMO-CHEMICAL CER.—5 cr. (3 and 6)

Cr En 402—CERAMIC BODIES—3 cr. (3 and 0)

Cr En 403—GLASSES—3 cr. (3 and 0)

Cr En 404—ENAMELS—3 cr. (3 and 0)

Cr En 410—GLASS MANUFACTURE—3 cr. (3 and 0)

Cr En 412—RAW MATERIAL PREPARATION—3 cr. (3 and 0)

---

*Hours of credit to be arranged with instructor. Credit will be given under Bot 505 for special problems performed in connection with other graduate courses.

Cr En 416—CEMENT, LIME AND PLASTER—3 cr. (3 and 0)

Cr En 418—PROCESS CONTROL—3 cr. (3 and 0)

Cr En 501—ADVANCED ANALYTICAL PROCEDURES AND EQUIPMENT—3 cr. (2 and 3)
A study of the use and application of the X-ray, spectograph, and electron microscope in ceramics.

Cr En 502—SILICATE CRYSTALLOGRAPHY—3 cr. (3 and 0)
A study of the basic laws of chemical crystallography and their application to the structure of silicate minerals.

Cr En 503—CERAMIC PRODUCTION CONTROL—3 Cr. (3 and 0)
A study of the techniques and procedures for providing the required quantity and quality of materials at the required time and place in ceramic industries. Motion study, job analysis, job and wage evaluation in these industries.

Cr En 504—CERAMIC QUALITY CONTROL—3 cr. (3 and 0)
A study of organization and procedure for quality control in ceramic industries. Practices and techniques used for systematic control of ceramic products and materials.

Cr En 505—ADVANCED DRYING—3 cr. (2 and 3)
An advanced study of drying fundamentals, drying problems, and dryer design.

Cr En 506—ADVANCED FIRING—3 cr. (2 and 3)
An advanced study of fuels, combustion, heat transfer, firing problems, and firing equipment.

Cr En 507—SPECIALIZED CERAMICS—3 cr. (3 and 0)
An advanced study of one of the divisions of ceramics. The student may select either structural products, refractories, whitewares, abrasives, enamels, glass, elements, or raw materials processing.

Cr En 591—RESEARCH—3 cr.

Cr En 592—RESEARCH—3 cr.

CHEMICAL ENGINEERING

ChE 301—PRINCIPLES OF CHEMICAL ENGINEERING—3 cr. (3 and 0)

ChE 302—PRINCIPLES OF CHEMICAL ENGINEERING—3 cr. (3 and 0)

ChE 306—UNIT OPERATIONS—1 cr. (0 and 3)

ChE 330—CHEMICAL ENGINEERING THERMODYNAMICS—2 cr. (2 and 0)

ChE 401—PRINCIPLES OF CHEMICAL ENGINEERING—3 cr. (3 and 0)

ChE 406—INDUSTRIAL CHEMICAL CALCULATIONS—2 cr. (2 and 0)

ChE 407—UNIT OPERATIONS—2 cr. (0 and 6)

ChE 409—PLANT DESIGN—2 cr. (0 and 6)

ChE 415—INTRODUCTION TO NUCLEAR ENGINEERING—3 cr. (3 and 0)

ChE 416—INTRODUCTION TO NUCLEAR ENGINEERING—3 cr. (3 and 0)

ChE 420—CORROSION—3 cr. (3 and 0)

ChE 421—DIMENSIONAL ANALYSIS AND THE THEORY OF MODELS —3 cr. (2 and 0)

ChE 422—INDUSTRIAL WASTE TREATMENT—2 cr. (2 and 0)

ChE 430—CHEMICAL ENGINEERING THERMODYNAMICS—3 cr. (3 and 0)

CHEMISTRY

A graduate student who registers for graduate work in Chemistry must have satisfactorily completed as a minimum the following undergraduate courses before he formally becomes a candidate for the degree. Anyone who has not satisfied these requirements before entering the graduate school will be required to include such courses in his graduate program, which may result in increasing the minimum number of credit hours necessary for his securing the Master's degree in Chemistry.

One year of General Chemistry	One course in Qualitative Analysis (if not included in General Chemistry)
One year of Organic Chemistry	One course in Elementary Quantitative Analysis

A placement examination is required of each student at the time he begins his graduate program. A satisfactory performance is required on a comprehensive written examination at least two months prior to the final oral examination.

Before receiving his degree a student must demonstrate a satisfactory reading knowledge of a modern foreign language. This language will ordinarily be German unless some other language is recommended by the student's committee.

Either a major or minor may be taken in one or more of the following fields of Chemistry: Inorganic, Analytical, Organic or Physical. A minor may also be taken in some field other than Chemistry.

*Chem 310—AGRICULTURAL BIOCHEMISTRY—4 cr. (3 and 3)

*Chem 323—ELEMENTARY ORGANIC CHEMISTRY—4 cr. (3 and 3)

*Chem 324—ELEMENTARY ORGANIC CHEMISTRY—4 cr. (3 and 3)

*Chem 331—PHYSICAL CHEMISTRY—5 cr. (3 and 6)

*Chem 332—PHYSICAL CHEMISTRY—5 cr. (3 and 6)

*Chem 335—PHYSICAL CHEMISTRY—3 cr. (3 and 0)

*Chem 336—PHYSICAL CHEMISTRY—2 cr. (2 and 0)

*Chem 337—PHYSICAL CHEMISTRY—4 cr. (3 and 3)

*Chem 338—PHYSICAL CHEMISTRY—4 cr. (3 and 3)

*Chem 401—INORGANIC CHEMISTRY—2 cr. (2 and 0)

*Chem 402—INORGANIC CHEMISTRY—3 cr. (2 and 3)

Chem 411—INSTRUMENTAL ANALYSIS—3 cr. (1 and 6)

Chem 421—QUALITATIVE ORGANIC ANALYSIS—3 cr. (1 and 6)

Chem 423—GENERAL BIOCHEMISTRY—3 cr. (3 and 0)

Chem 424—GENERAL BIOCHEMISTRY—3 cr. (3 and 0)

Chem 454—INORGANIC SYNTHESIS—2 cr. (0 and 6)

Chem 472—ORGANIC SYNTHESIS—3 cr. (1 and 6)

Chem 491—INTRODUCTION TO RADIO CHEMISTRY—3 cr. (2 and 3)

Chem 503—INORGANIC CHEMISTRY—2 cr. (2 and 0)
A comprehensive review of the field of inorganic chemistry.

Chem 504—INORGANIC CHEMISTRY—2 cr. (2 and 0)
A continuation of Chem 503.

Chem 505—ADVANCED INORGANIC CHEMISTRY—3 cr. (3 and 0)
A study of atomic crystal and molecular structure and its relationship to inorganic chemistry. **Prerequisites:** Chem 401 and 402 or 503 and 504.

Chem 511—ADVANCED ANALYTICAL CHEMISTRY—3 cr. (3 and 0)
This course includes error analysis, the elementary statistical theory involved in procedures, and design of experiments and certain industrial control methods. Selected methods for the determination of a few elements not covered in the elementary courses are discussed as well as the less commonly used physico-chemical methods. **Prerequisites:** Chem 331 and 332 or 530 and 531.

Chem 512—CHEMICAL SPECTROSCOPIC METHODS—3 cr. (2 and 3)
This course is designed to give the student an understanding of the principles of spectroscopic procedures. Both absorption and emission techniques will be considered. Emphasis will be placed on ultraviolet and infrared as well as visible spectra.

Chem 520—INTERMEDIATE ORGANIC CHEMISTRY—3 cr. (3 and 0)
A comprehensive review of the field of organic chemistry.

---

*Courses which may be used for a minor in chemistry by students majoring in other fields.

Chem 521—ADVANCED ORGANIC CHEMISTRY—3 cr. (3 and 0)
The object of this course is to give a general survey of organic chemistry with special attention given to the general types of organic reactions and to important processes. The lectures are supplemented by assigned problems and reports on current organic literature which are discussed during a weekly conference. **Prerequisite:** Chem 520.

Chem 530—PHYSICAL CHEMISTRY—3 cr. (3 and 0)
A comprehensive review of the field of physical chemistry. The student will also be required to take laboratory work if he has not been sufficiently well grounded previously in this phase of the subject. **Prerequisites:** Courses in qualitative analyses, organic chemistry, and a working knowledge of integral calculus.

Chem 531—PHYSICAL CHEMISTRY—3 cr. (3 and 0)
A continuation of Chem 530.

Chem 532—ADVANCED PHYSICAL CHEMISTRY—3 cr. (3 and 0)
An advanced course covering special phases of physical chemistry such as recent advances in the theory of solutions, chemical kinetics, catalysis and phase equilibrium. **Prerequisites:** Chem 530 and 531.

Chem 541—ATOMIC AND MOLECULAR STRUCTURE—3 cr. (3 and 0)
The purpose of this course is to strengthen the student's understanding of atomic structure and to extend his knowledge of the structure of molecules. Major emphasis will be given to studying the relationship of structure to physical and chemical properties with examples drawn from both the organic and inorganic fields.

Chem 591—RESEARCH—3 cr.

Chem 592—RESEARCH—3 cr.

CIVIL ENGINEERING

CE 305—ROUTE SURVEYING—3 cr. (2 and 3)

CE 307—ROADS AND PAVEMENTS—3 cr. (2 and 3)

CE 309—TRUSSES—1 cr. (0 and 3)

CE 310—STRUCTURES—3 cr. (2 and 3)

CE 317—MATERIALS AND METHODS OF CONSTRUCTION—2 cr. (2 and 0)

CE 401—STRUCTURAL DESIGN—3 cr. (2 and 3)

CE 402—STRUCTURAL ANALYSIS—2 cr. (2 and 0)

CE 409—REINFORCED CONCRETE STRUCTURES—4 cr. (3 and 3)

CE 410—MUNICIPAL AND SANITARY ENGINEERING—3 cr. (2 and 3)

CE 412—REINFORCED CONCRETE DESIGN—2 cr. (1 and 3)

CE 414—SOIL MECHANICS—3 cr. (2 and 3)

CE 417—CITY PLANNING—2 cr. (2 and 0)

CE 452—ADVANCED STRUCTURAL ANALYSIS—2 cr. (2 and 0)

CE 501—ADVANCED STRUCTURAL ENGINEERING—3 cr. (2 and 3)
Analysis of statistically indeterminate structures including secondary stresses and rigid frames.

CE 502—ADVANCED STRUCTURAL ENGINEERING—3 cr. (2 and 3)
A continuation of CE 501.

CE 503—MODEL ANALYSIS—3 cr. (2 and 3)
Methods of determining moments and stresses from a study of models: Principals of similitude: use of the Beggs deformator. **Prerequisites:** Graduate standing and approval of instructor.

CE 510—HIGHWAY SAFETY AND TRAFFIC CONTROL—3 cr. or 2 cr. (3 and 0) or (2 and 0)
Study of highway safety principles affecting the design of city streets and rural highways, devices for controlling highway traffic and related subjects, and design of traffic signal systems. **Prerequisite:** CE 307.

CE 511—HIGHWAY DESIGN—3 cr. (2 and 3)
Studies of economics of highway grades, location, alignment with road surfaces, and factors that control highway planning. **Prerequisites:** CE 307.

CE 519—HIGHWAY RESEARCH—2 to 4 cr.
Independent investigation of some problems in highway engineering.

CE 520—CONCRETE MIXES AND MATERIALS—3 cr. (2 and 3)
Properties and factors controlling properties of concrete: investigation and selection of materials; mixes and design of mixes; inspection, field laboratory facilities and reports; concrete manufacture; handling, placing and curing; special types; sonic method of testing. **Prerequisite:** CE 409.

CE 531—SOIL ENGINEERING—3 cr. (2 and 3)
Shearing resistance consolidation, settlement, displacement and compaction, pile supporting strength, application of principles to earthwork, foundations and highway problems. **Prerequisite:** CE 414.

CE 591—RESEARCH—3 cr.

CE 592—RESEARCH—3 cr.

DAIRY

Dairy 306—MARKET MILK—3 cr. (3 and 0)

Dairy 352—ADVERTISING AND MARKETING—3 cr. (3 and 0)

Dairy 354—ENDOCRINOLOGY—3 cr. (3 and 0)

Dairy 401—DAIRY MANUFACTURES—3 cr. (2 and 3)

Dairy 402—DAIRY MANUFACTURES—4 cr. (2 and 6)

Dairy 403—ANIMAL NUTRITION—3 cr. (3 and 0)

Dairy 405—DAIRY CATTLE BREEDING—3 cr. (2 and 3)

Dairy 452—DAIRY CATTLE FEEDING AND MANAGEMENT—3 cr. (2 and 3)

Dairy 501—TOPICAL PROBLEMS—1 to 3 cr.
Topics of interest to the graduate students. The course is designed to give experience with problems in dairying not covered by thesis research. Credit varies with the problems selected.

Dairy 502—GENEICS OF DAIRY CATTLE IMPROVEMENT—3 cr. (3 and 0)
A study of the inheritance in dairy cattle, with emphasis on milk and butterfat production, methods used in proving sires and dams and in analyzing herds as aids to selection.

Dairy 503—PHYSIOLOGY OF REPRODUCTION AND MILK SECRETION —3 cr. (3 and 0)
A study of the influence of the endocrine glands on reproduction and on milk secretion.

Dairy 505—NEWER KNOWLEDGE OF ANIMAL NUTRITION—3 cr. (3 and 0)
The application of the latest information on digestion, metabolism, and the nutritional requirements of animals.

Dairy 507—FERMENTED DAIRY PRODUCTS—3 cr. (2 and 3)
A study of the biological and chemical changes involved in the processing and aging of cheese, Yoghurt and other fermented dairy products.

Dairy 508—INDUSTRIAL DAIRY SCIENCE—3 cr. (3 and 0)
This course is designed to provide advanced technological training in dairy plant processing and manufacturing.

Dairy 591—RESEARCH—3 cr.

Dairy 592—RESEARCH—3 cr.

DRAWING AND DESIGN

DD 401—FUNDAMENTALS OF MACHINE DESIGN—3 cr. (3 and 0)
Studies in making decisions. Development of creative ability in the syn-

thesis of machines and machine elements. The role of stress and strain. A brief review of materials, their properties, and methods of working them. Special emphasis is given to fatigue and combined stresses as applied to the design of modern machinery. **Prerequisite:** DD 308, Mech 304 and Senior standing. Co-requisite: IE 402.

DD 402—THE DESIGN OF MACHINE ELEMENTS—3 cr. (2 and 3)
A continuation of DD 401. A study of current methods in use for the design of various machine parts. Particular attention is paid to the limitations of existing design methods in view of the emphasis on high speeds, heavy loads and light weights of today's machines. **Prerequisite:** DD 401.

DD 408—THESIS—1 cr. (0 and 3)
The development of an original solution to a current machine design problem. **Prerequisite:** DD 401.

DD 460—MECHANICAL VIBRATIONS—3 cr. (3 and 0)
A study of mechanical vibrations with emphasis upon the solution of practical problems in the design and construction of machinery and structures. The study includes free vibrations with and without damping; forced vibrations; systems of one, two and many degrees of freedom; Raleigh's method applied to linear vibrations; Holzer's method applied to torsional vibrations; equivalent systems; measuring instruments; absorbers and dampers; the seismograph; self-excited vibrations; linear systems. **Prerequisites:** Mech 303 and 304.

DD 464—LUBRICATION—2 cr. (2 and 0)
Application of hydrodynamic and hydrostatic theory to the design and analysis of journal and thrust bearings. **Prerequisite:** DD 401.

DD 501—DESIGN PROBLEMS IN VIBRATIONS AND DYNAMICS—3 cr. (3 and 0)
The application of vibration theory and dynamics to the design of machinery, critical speeds and inertia disturbances, equivalent systems, nonlinear systems, isolators, damping devices, and vibration instruments. **Prerequisite:** Math 455 or approval of instructor.

DD 502—PLASTICITY—3 cr. (2 and 3)
A study of the behavior of metal machine elements in the plastic region. Development of current theories of failure and application of these to problems involving tension, compression, torsion, bending, and various combinations. **Prerequisite:** Math 306.

DD 503—PHOTOELASTICITY—3 cr. (2 and 3)
Development of fundamental relations, study of the polariscope, stress distribution, and short unsolved problems.

ECONOMICS AND SOCIOLOGY

To be eligible to obtain graduate credit in Economics or Sociology the student must have earned at least twelve semester hours credit for under-

graduate work in these fields. The graduate student will schedule courses along with undergraduates, but will be expected to complete such additional assignments as the instructor may require.

Econ 403—THE DEVELOPMENT OF ECONOMIC THOUGHT—3 cr. (3 and 0)

Econ 412—INTERNATIONAL TRADE—3 cr. (3 and 0)

Soc 403—CRIMINOLOGY—3 cr. (3 and 0)

Soc 405—INDUSTRIAL SOCIOLOGY—3 cr. (3 and 0)

EDUCATION

Graduate work in professional education includes courses in the following areas: (1) industrial education, (2) administration and supervision, (3) guidance services, and (4) instructional methods in classrooms and laboratories. Each candidate for a Master of Science degree with a major in Education or a major in Industrial Education will select a minimum of nine semester credits within **one** of the areas listed above, and will select a minor of at least six semester credits in a field other than professional edution. Each candidate's program must be approved by the departmental faculty advisers and by the Dean of the Graduate School. Graduate students who enroll in courses numbered less than 500 will be permitted to meet such classes with undergraduates, but will be required by their instructors to complete additional assignments on a graduate level.

It is expected that graduate students in Education or in Industrial Education will have completed all undergraduate requirements for the South Carolina Class III teaching certificate, but undergraduate deficiences may be met by scheduling them concurrently with graduate work when approved by the faculty advisers.

Education 591 is required of all master's degree candidates in professional education. Each candidate will also complete Education 594, **or** Education 596, and will submit an acceptable thesis report on an approved research problem.

Ed 421—COORDINATION METHODS IN VOCATIONAL EDUCATION—2 cr. (2 and 0)

Ed 432—JOB ANALYSIS AND COURSE CONSTRUCTION—3 cr. (3 and 0)

Ed 446—SHOP PLANNING AND LAYOUT—3 cr. (3 and 0)

Ed 460—CURRICULUM DEVELOPMENT IN THE ELEMENTARY SCHOOL—3 cr. (3 and 0)

Ed 494—SCHOOL AND COMMUNITY RELATIONSHIPS—3 cr. (3 and 0)

Ed 496—PUBLIC AND INDUSTRIAL RELATIONS FOR VOCATIONAL TEACHERS AND SUPERVISORS—3 cr. (3 and 0)

Ed 497—AUDIO VISUAL AIDS IN EDUCATION—3 cr. (3 and 0)

Ed 503—ADVANCED METHODS IN TEACHING—3 cr. (3 and 0)
The principles and practices involved in promoting effective learning are developed in this course which is planned primarily to assist experienced teachers who wish to improve their teaching procedures. Creating interest, inducing desired learning, activities, causing intelligent use of what is learned, and measuring and evaluating results of teaching will be emphasized.

Ed 505—OCCUPATIONAL GUIDANCE AND PLACEMENT—3 cr. (3 and 0)
The organization and administration of a guidance program for public schools. An analysis is made of procedures and techniques used in guidance. Data are collected on placement activities and follow-up work. A careful study is made of the needs for guidance in communities near the college. (This is the basic course in guidance which is required in South Carolina for certification as a counselor in a high school.)

Ed 506—HISTORY AND PHILOSOPHY OF EDUCATION—3 cr. (3 and 0)
This course attempts to study the development of education over the different periods of civilization beginning with Athenian education and tracing the educational movements through the different periods of history with emphasis being placed upon the development of education in the United States. With each period studied attention is first directed to the central features of the social order, the dominant ideology, to the social structure, the classes of economic interest, and to the sources of political power and the formation of political institutions and social arrangements. Education policies and practices and newer philosophy of American education are given detailed attention.

Ed 508—EDUCATIONAL TESTS AND MEASUREMENTS—3 cr. (3 and 0)
A study of improved methods and techniques which are used in the measurement of intelligence, special aptitudes, and achievement. A survey is made of standardized tests, the sources from which they may be secured and the purposes which they may serve in classification and/or instruction of students. Emphasis is given to the construction of informal tests of achievement, and to the administration and interpretation of standardized tests. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.)

Ed 509—ANALYSIS OF THE INDIVIDUAL—3 cr. (3 and 0)
Emphasis is placed on the study and use of techniques of discovering the characteristics of individuals. Training experiences are provided in securing, recording, and interpreting significant data as they relate to counseling. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.) **Prerequisites:** Eighteen semester credits in undergraduate and/or graduate professional education, or two years of experience in teaching.

Ed 510—TECHNIQUES OF COUNSELING—3 cr. (3 and 0)
This course is designed to assist graduate students in developing competencies which are needed when dealing with the problems of individuals in counseling situations. Emphasis is placed upon these major objectives in interviewing: (a) securing information, (b) furnishing information, and (c) helping counselors to interpret information in making acceptable decisions. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.) **Prerequisites:** Completion of six credits from Ed 505, 508, 509 or 513.

Ed 511—PUBLIC SCHOOL ADMINISTRATION (Finance)—3 cr. (3 and 0)
A study of sound principles and suitable procedures relating to school administration and finance, especially for the size of school districts represented by the membership of the class.

Ed 513—EDUCATIONAL AND OCCUPATIONAL INFORMATION—3 cr. (3 and 0)
An examination and evaluation is made of techniques for collecting, filing, interpreting, and using occupational information in counseling. Practice in the use of these techniques is emphasized. Community surveys and follow-up studies are considered as means of securing pertinent information. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.)

Ed 516—HISTORY AND PHILOSOPHY OF VOCATIONAL EDUCATION —3 cr. (3 and 0)
A comprehensive course including the development of vocational education to the present time, the influence of European vocational programs on the United States, and the Federal Vocational Acts policies. Current problems and trends are discussed.

Ed 518—ORGANIZATION AND ADMINISTRATION OF ELEMENTARY SCHOOL—3 cr. (3 and 0)
This course is an approach to the organization of the elementary school in terms of improved situations for students, teachers, and administrators. It deals with problems of curriculum design and implementation in terms of needs of modern society and the resultant implication for curriculum development. The course includes comprehensive discussion of the duties and responsibilities of the elementary principal in improving educational opportunities.

Ed 521—ADULT EDUCATION DEVELOPMENT AND ADMINISTRATION —3 cr. (3 and 0)
A critical analysis of the adult education movement and its influence on trade and industrial workers; the applicability of education practices to industrial training problems; major fields of training in industry; evaluation of unions participation in education programs; psychological approaches to problems in worker-management relations.

Ed 530—TECHNIQUES OF SUPERVISION—THE PUBLIC SCHOOLS—3 cr. (3 and 0)

This course is designed for teachers, supervisors, and administrators who are interested in improving, coordinating, and evaluating instruction. Modern trends of supervisory practices will be emphasized.

Ed 531—PUBLIC SCHOOL EVALUATION—3 cr. (3 and 0)

To determine the effectiveness of a school program its work should be measured by recognized educational critera. The regional accrediting agencies have developed gauges and devices which are worthwhile instruments when used by competent educators. Total personal growth, subject matter progress, and physical facilities should be evaluated in terms of desirable standards. Development of total long-term plans should be carefully evaluated against community needs. The objectives of this course include those mentioned above and problems presented by members of the class.

Ed 561—ADMINISTRATION AND SUPERVISION OF VOCATIONAL EDUCATION—3 cr. (3 and 0)

The expanding program of vocational education under the George-Barden Act and problems on national, state and local levels are discussed. Major specific problems in unit trade programs, and out-of-school youth, selection and training of teachers, veteran training and others are covered.

Ed 591—INTRODUCTION TO RESEARCH IN EDUCATION—3 cr. (3 and 0)

The course attempts to familiarize the graduate students in education with the methods and techniques common to educational research, and to give training and experience in evaluating research. Studies and theses of various types are examined and summarized.

Ed 594—RESEARCH IN EDUCATION—3 cr. (3 and 0)

A continuation of Educ 591. The student will conduct individual research on an approved problem in education. The student may submit a report on this research, which, if acceptable to his examining committee, will meet the thesis requirement.

Ed 596—RESEARCH IN INDUSTRIAL EDUCATION—3 cr. (3 and 0)

A continuation of Educ 591. The student will conduct individual research on an approved problem in industrial education. The student may submit a report on this research, which, if acceptable to his examining committee, will meet the thesis requirement.

ELECTRICAL ENGINEERING

EE 312—ELECTRICAL MACHINERY I—3 cr. (3 and 0)

EE 313—BASIC ELECTRICAL MEASUREMENTS—2 cr. (2 and 0)

EE 314—ELECTRICAL MACHINERY I LABORATORY—1 cr. (0 and 3)

EE 315—ALTERNATING-CURRENT CIRCUITS—4 cr. (3 and 3)

EE 316—ALTERNATING-CURRENT CIRCUITS—3 cr. (3 and 0)

EE 317—MEASUREMENTS LABORATORY—1 cr. (0 and 3)

EE 320—ELECTRONICS I—3 cr. (3 and 0)

EE 321—PRINCIPLES OF ILLUMINATION—3 cr. (3 and 0)

EE 322—ELECTRONICS I LABORATORY—1 cr. (0 and 3)

EE 402—ENGINEERING ANALYSIS—1 cr. (0 and 3)

EE 407—ELECTRONICS II—3 cr. (3 and 0)

EE 409—ELECTRONICS II LABORATORY—1 cr. (0 and 3)

EE 410—TRANSIENTS AND SERVOMECHANISMS—3 cr. (3 and 0)

EE 415—ADVANCED CIRCUITS—3 cr. (3 and 0)

EE 417—ELECTRICAL MACHINERY II—3 cr. (3 and 0)

EE 419—ELECTRICAL MACHINERY II LABORATORY—1 cr. (0 and 3)

EE 422—ELECTRICAL DISTRIBUTION—2 cr. (2 and 0)

EE 431—RADIO COMMUNICATION—4 cr. (3 and 3)

EE 432—RADIO COMMUNICATION—4 cr. (3 and 3)

EE 434—INDUSTRIAL ELECTRONIC CONTROLS—3 cr. (2 and 3)

EE 436—RADIATION AND WAVE PROPAGATION—3 cr. (3 and 0)

EE 501—TRANSIENTS IN LINEAR SYSTEMS—3 cr. (3 and 0)
A study of linear electrical and mechanical systems using the Laplace transformation to determine transient as well as steady-state response.

EE 510—CLOSED-LOOP CONTROL SYSTEMS—3 cr. (3 and 0)
The application of Laplace transform methods as well as transfer-function analysis to the study of regulators, servomechanisms, and other automatic control systems.

EE 511—ELECTRIC POWER STATIONS—3 cr. (3 and 0)
A comprehensive study of station lay-out, generating equipment, exciters, transformers, meters, switching and protective devices. Economical arrangement and operation are emphasized.

EE 521—RADIATION AND WAVE PROPAGATION—3 cr. (3 and 0)
An advanced study of electric fields, vector analysis, Maxwell's equations and their use in the study of wave guides, radiation and wave propagation.

EE 530—PULSE TECHNIQUES—4 cr. (3 and 3)
Analysis of basic circuits applicable to pulse-modulation communication systems, computers, high-speed time measurements, and cathode-ray in-

strumentation. Principles involved in electronic instruments for nuclear measurements, nuclear reactor control, and other applications involving pulsed electrical energy.

ENGLISH

Students who expect graduate credit in English courses should present at least six semester hours of undergraduate credit in English or American literature above the sophomore level. Graduate students will schedule courses with undergraduates, but will be expected to complete such additional assignments as the instructor may require.

Engl 405—SHAKESPEARE—3 cr. (3 and 0)

Engl 406—SHAKESPEARE—3 cr. (3 and 0)

Engl 409—CHAUCER—3 cr. (3 and 0)

Engl 423—AMERICAN LITERATURE—3 cr. (3 and 0)

Engl 424—AMERICAN LITERATURE—3 cr. (3 and 0)

Engl 425—THE ROMANTICS—3 cr. (3 and 0)

Engl 427—VICTORIAN LITERATURE—3 cr. (3 and 0)

Engl 431—RESTORATION AND EIGHTEENTH CENTURY—3 cr. (3 and 0)

Engl 433—CONTEMPORARY BRITISH LITERATURE—3 cr. (3 and 0)

Engl 434—CONTEMPORARY AMERICAN LITERATURE—3 cr. (3 and 0)

Engl 435—SOUTHERN LITERATURE—3 cr. (3 and 0)

ENTOMOLOGY

Ent 305—ECONOMIC ENTOMOLOGY—3 cr. (2 and 3)

Ent 306—ECONOMIC ENTOMOLOGY—3 cr. (2 and 3)

Ent 405—INSECT MORPHOLOGY—3 cr. (2 and 3)

Ent 408—GENERAL AND TAXONOMIC ENTOMOLOGY—5 cr. (3 and 6)

Ent 468—INTRODUCTION TO RESEARCH—2 cr. (1 and 3)

Ent 505—ADVANCED MORPHOLOGY—3 cr. (2 and 3)
Principles of insect morphology with the detailed morphology of a taxonomic group. **Prerequisite:** Ent 405.

Ent 552—ADVANCED SYSTEMATIC ENTOMOLOGY—2 cr. (0 and 6)
A survey of taxonomic literature with a detailed study of a selected taxonomic group. **Prerequisite:** Ent 408.

Ent 556—MEDICAL ENTOMOLOGY—3 cr. (2 and 3)
Disease vectors of animals with emphasis on insects and related Arthropod disease carriers. **Prerequisites:** Ent 301.

Ent 561—INSECT TOXOCOLOGY—3 cr. (2 and 3)
History, development, application, chemical nature and mode of action of insects. **Prerequisites:** Chem 220 and Ent 405.

Ent 562—INSECT PHYSIOLOGY—3 cr. (2 and 3)
The physiology of nutrition, digestion, respiration, excretion, nervous and hormonal systems. **Prerequisites:** Chem 220 and Ent 405.

Ent 563—SPECIAL PROBLEMS IN ENTOMOLOGY—3-6 cr.
Original investigation of special problems in entomology not related to a thesis but designed to provide experience and training in research. Emphasis will be placed on insect toxicology, insect physiology, medical entomology and biological control of insects.

Ent 590—RESEARCH TECHNIQUES IN AGRICULTURE—3 cr. (2 and 3)
This course is designed to give the student a comprehensive understanding of research procedures and techniques in solving problems in the various fields of agriculture. Special attention will be given to the design of experiments, interpretation of results and report writing. The student will be expected to prepare a written report on a selected problem.

Ent 591—RESEARCH—3 cr.

Ent 592—RESEARCH—3 cr.

HISTORY AND GOVERNMENT

To be eligible to obtain graduate credit in History and Government the student should have earned at least twelve semester hours of undergraduate work in this field. The graduate student will schedule the course along with advanced undergraduates, but will be expected to complete such additional assignments as the instructor may require.

Gov 401—COMPARATIVE GOVERNMENT—3 cr. (3 and 0)

Hist 401—HISTORY OF SOUTH CAROLINA—3 cr. (3 and 0)

Hist 403—HISTORY OF THE SOUTH TO 1885—3 cr. (3 and 0)

Hist 404—HISTORY OF THE SOUTH SINCE 1865—3 cr. (3 and 0)

Hist 405—THE AMERICAN FRONTIER—3 cr. (3 and 0)

Hist 406—HISTORY OF MANUFACTURING IN THE UNITED STATES—3 cr. (3 and 0)

Hist 407—DIPLOMATIC HISTORY OF THE UNITED STATES—3 cr. (3 and 0)

Hist 408—EUROPE SINCE 1914—3 cr. (3 and 0)

Hist 409—HISTORIOGRAPHY AND RESEARCH METHODS—2 cr. (1 and 2)

HORTICULTURE

Hort 302—PRINCIPLES OF VEGETABLE PRODUCTION—3 cr. (2 and 3)

Hort 310—FLORICULTURE—3 cr. (2 and 3)

Hort 352—COMMERCIAL POMOLOGY—3 cr. (2 and 3)

Hort 402—GARDEN DESIGN—3 cr. (2 and 3)

Hort 405—NUT CULTURE AND SPRAYS—3 cr. (2 and 3)

Hort 407—ELEMENTARY LANDSCAPE DESIGN—3 cr. (2 and 3)

Hort 451—SYSTEMATIC POMOLOGY AND SMALL FRUIT CULTURE—3 cr. (2 and 3)

Hort 456—TRUCK CROPS—3 cr. (2 and 3)

Hort 460—ADVANCED LANDSCAPE DESIGN—5 cr. (3 and 6)

Hort 464—FOOD PRESERVATION—3 cr. (2 and 3)

Hort 468—INTRODUCTION TO RESEARCH—2 cr. (1 and 3)

Hort 501—PROBLEMS IN SMALL FRUIT PRODUCTION—3 cr. (2 and 3)
This course involves a study of selected problems encountered in the production of blueberries, strawberries, brambles and grapes. **Prerequisite:** Hort 451.

Hort 503—ADVANCED VEGETABLE CROPS—3 cr. (2 and 3)
This involves a systematic study of sources of information and practices with emphasis on the application and handling of vegetable crops. **Prerequisite:** Hort 456.

Hort 505—FOOD TECHNOLOGY—3 cr. (1 and 6)
This course includes quality control methods and equipment such as special titrations, taste panels, refractometers, succulometers, tenderometers, and colorimeters; the role of sugars, salts, and acids and chemical preservatives in foods; quality grade standards, and special problems. **Prerequisites:** Bact 301, 303, Hort 464.

Hort 507—ADVANCED POMOLOGY—3 cr. (2 and 3)
A study of the growth and development of decidious fruits with most emphasis on the peach and apple. **Prerequisite:** Hort 452.

Hort 591—RESEARCH—3 cr.

Hort 592—RESEARCH—3 cr.

INDUSTRIAL ENGINEERING

IE 310—INTRODUCTION TO THE ENGINEERING SCIENCES—3 cr. (3 and 0)

IE 402—METALLURGY—3 cr. (2 and 3)

MATHEMATICS

Math 302—THEORY OF EQUATIONS—3 cr. (3 and 0)

Math 303—STATISTICS—3 cr. (3 and 0)

Math 304—STATISTICS—3 cr. (3 and 0)

Math 306—ORDINARY DIFFERENTIAL EQUATIONS—3 cr. (3 and 0)

Math 307—ELEMENTARY PARTIAL DIFFERENTIAL EQUATIONS—3 cr. (3 and 0)

Math 308—NUMERICAL ANALYSIS—3 cr. (2 and 3)

Math 451—VECTOR ANALYSIS—3 cr. (3 and 0)

Math 452—FOURIER SERIES—3 cr. (3 and 0)

Math 453—ADVANCED CALCULUS—3 cr. (3 and 0)

Math 454—ADVANCED CALCULUS—3 cr. (3 and 0)

Math 501—PARTIAL DIFFERENTIAL EQUATIONS—3 cr. (3 and 0)
This course contains analysis theory which has wide application in applied mathematics and the allied fields of physics, engineering, and chemistry. The topics include orthogonal functions, Fourier series, Bessel functions, Legendre polynominals, Sturm-Liouville systems.

Math 502—DETERMINANTS AND MATRICES—3 cr. (3 and 0)
This course should be of benefit to students who plan to do further graduate work in mathematics, engineering or physics. Some of the topics included in the course are determinants, polynominals and forms, transformations, system of linear equations.

Math 503—THEORY OF FUNCTIONS OF COMPLEX VARIABLES—3 cr. (3 and 0)
This is a basic course in analysis which has wide application in applied mathematics and allied fields. This course should be of interest primarily to mathematics and physics majors and possibly to engineering majors if they plan further study. The topics in the course include differentiation and integration of analytic functions, power series, residues, contour integration, analytic continuation, and conformal mapping.

Math 504—THEORY OF FUNCTIONS OF COMPLEX VARIABLES—3 cr. (3 and 0)
A continuation of Math 503.

Math 591—RESEARCH—3 cr.

Math 592—RESEARCH—3 cr.

MECHANICAL ENGINEERING

ME 411—GAS POWER—3 cr. (3 and 0)

ME 412—STEAM POWER—3 cr. (3 and 0)

ME 413—MECHANICAL ENGINEERING LABORATORY—1 cr. (0 and 3)

ME 414—MECHANICAL ENGINEERING LABORATORY—1 cr. (0 and 3)

ME 417—ENGINEERING ANALYSIS—1 cr. (0 and 3)

ME 422—PRINCIPLES OF TURBOMACHINERY—3 cr. (3 and 0)

ME 423—INTERNAL COMBUSTION ENGINE ANALYSIS—1 cr. (0 and 3)

ME 429—AIR CONDITIONING—3 cr. (3 and 0)

ME 430—AIR CONDITIONING DESIGN—1 cr. (0 and 3)

ME 433—ELEMENTARY AERODYNAMICS—3 cr. (3 and 0)

ME 434—REFRIGERATION—3 cr. (2 and 0)

ME 501—ADVANCED AIR CONDITIONING—3 cr. (3 and 0)
An analysis of the principles of air conditioning. The following topics are among those covered; enthalphy of air-vapor mixtures; adiabatic mixtures of air with water, steam or ice; fogged air; adiabatic saturation; air in contact with water; fundamental simultaneous and fundamental successive conditioning processes; humid air below 32 degrees F., geometry of the psychrometric chart. A critical analysis of current literature on special topics. **Prerequisite:** ME 429.

ME 510—ADVANCED THERMODYNAMICS—3 cr. (3 and 0)
This course supplements and extends the material covered in elementary thermodynamics. Special topics relative to advanced problems in engineering are pursued. **Prerequisites:** ME 311, 312, and registration in Math 306.

ME 511—THERMODYNAMICS OF COMPRESSIBLE FLUID FLOW—3 cr. (3 and 0)
An application of thermodynamics to the flow of compressible fluids. Topics to be covered include concepts of compressible flow, isentropic flow, normal shock waves, flow in constant area ducts with friction, flow in ducts with heating or cooling, generalized one-dimensional continuous flow, introduction to flow in two and three dimensions, concepts of stream function and velocity potential.

ME 521—ADVANCED INTERNAL COMBUSTION ENGINES—3 cr. (3 and 0)

Internal combustion process analysis, deviation from the ideal processes, detonation, and knock testing, carburetion and fuel injection, combustion chamber and cylinder head design, engine cooling, mechanics of principle moving parts, engine vibration and balance and engine design.

ME 523—ADVANCED INTERNAL COMBUSTION ENGINE LABORATORY—1 cr. (0 and 3)

Analysis of engine instrumentation, airfuel ratio tests, detonation limited power test, injection and analysis with test apparatus, fuels testing and general test codes.

ME 524—ADVANCED GAS TURBINES—3 cr. (3 and 0)

Gas turbine process analysis, deviation from the ideal process, fuels stratification, efficiencies, pressure ratio, including the development of charts for cycle analysis.

ME 532—ADVANCED HEAT TRANSFER—3 cr. (3 and 0)

The application of heat transfer to several engineering problems pertaining to the design of heat transfer equipment such as boilers, condensers, evaporators, and air preheaters. **Prerequisites:** ME 308, Math 306.

ME 591—RESEARCH—3 cr.

ME 592—RESEARCH—3 cr.

MECHANICS AND HYDRAULICS

Mech 401—FLUID MECHANICS—3 cr. (3 and 0)

Mech 403—FLUID MECHANICS LABORATORY—1 cr. (0 and 3)

Mech 460—HYDROLOGY—2 or 3 cr. (2 or 3 and 0)

Mech 462—WATER POWER ENGINEERING—2 or 3 cr. (2 or 3 and 0)

Mech 464—FLOW IN OPEN CHANNELS—2 or 3 cr. (2 or 3 and 0)

Mech 502—SPECIAL TOPICS IN MECHANICS OF MATERIALS—3 cr. (3 and 0)

A study of the general state of stress, strain-energy methods, theories of failure, indeterminate problems in bending, curved bars, dynamic stresses, plates and problems of elastic stability. **Prerequisites:** Mech 304 and graduate standing.

Mech 504—DYNAMICS—3 cr. (3 and 0)

A development of more advanced methods of analysis of problems in dynamics with emphasis on practical solutions. Topics are systems with variable mass and variable forces, shaking forces, balancing, vibration, gyroscopes and models. **Prerequisites:** Mech 303 and graduate standing.

Mech 506—FLUID MECHANICS II—3 Cr. (3 and 0)

A comprehensive study of the principles of fluid flow and the application of the principles to practical engineering problems. Among the topics considered are fluid velocity and acceleration, significance of the flow net, pressure distributions, viscosity, surface tension, compressibility, boundary layer and circulation and magnus effect. **Prerequisites:** Mech 401 and graduate standing.

Mech 508—FLOOD CONTROL—3 cr. (3 and 0)

A study of the hydrology of floods and the engineering considerations relating to their control. Topics considered in the scope of control measures are economic justification, types of control structures, and survey of flood control measures on major streams in the U. S. **Prerequisites:** Mech 460 and graduate standing.

Mech 510—ADVANCED HYDROLOGY—2 cr. (2 and 0)

Special work to strengthen the student's background in modern methods. The technical literature is used extensively for the latest developments. Emphasis is laid on evaporation, infiltration and the synthetic hydrograph. **Prerequisites:** Mech 460 and graduate standing.

Mech 512—HYDRAULIC PROJECTS—3 cr. (3 and 0)

This course is devoted to the detailed investigation of engineering problems in hydraulics and related fields. Application of theoretical principles developed in previous courses is emphasized. Subjects include: Spillway and stilling basin; reservoirs; inverted siphons. **Prerequisites:** Mech 460, 464; must be accompanied or preceded by Mech 506.

Mech 591—RESEARCH—3 cr.

Mech 592—RESEARCH—3 cr.

PHYSICS

Graduate students majoring in Physics are normally expected to take at least two of the following three courses as a part of their graduate program; Physics 521, 541 and 542. Students majoring in this field are required to demonstrate a reading knowledge of one modern foreign language. It is suggested that these students select a minor in Mathematics, Chemistry or one of the branches of Engineering.

Phys 312—HEAT AND KINETIC THEORY—4 cr. (4 and 0)

Phys 314—EXPERIMENTAL HEAT—1 cr. (0 and 3)

Phys 321—MECHANICS AND PROPERTIES OF MATTER—4 cr. (4 and 0)

Phys 323—EXPERIMENTAL MECHANICS—1 cr. (0 and 3)

Phys 332—GEOMETRIC OPTICS AND INTRODUCTION TO PHYSICAL OPTICS—3 cr. (3 and 0)

Phys 341—ELECTRICITY AND MAGNETISM—3 cr. (3 and 0)

Phys 432—PHYSICAL OPTICS AND INTRODUCTION TO ATOMIC SPECTRA—3 cr. (3 and 0)

Phys 441—ELECTROMAGNETISM—3 cr. (3 and 0)

Phys 443—ELECTRICAL MEASUREMENTS—2 cr. (1 and 3)

Phys 451—MODERN PHYSICS—3 cr. (3 and 0)

Phys 452—ATOMIC AND NUCLEAR PHYSICS—3 cr. (3 and 0)

Phys 453—EXPERIMENTS IN MODERN PHYSICS—1 cr. (0 and 3)

Phys 454—NUCLEAR PHYSICS LABORATORY—1 cr. (0 and 3)

Phys 511—THERMODYNAMICS—3 cr. (3 and 0)
A study of the laws of the thermodynamics entrophy and properties of pure substance, engine cycles, the applications of thermodynamics to various systems and applications to chemical systems.

Phys 512—KINETIC THEORY AND STATISTICAL MECHANICS—3 cr. (3 and 0)
A development of the kinetic theory of gases including derivations of relationships between molecular diameters, distribution of velocities, mean free paths, viscosity, thermal conductivity, specific heat, entrophy, probability and reaction kinetics. The basic concepts of statistical mechanics for classical and quantum systems will be developed.

Phys 521—DYNAMICS—3 cr. (3 and 0)
A study of the more advanced phase of dynamics including the equations of Lagrange and Hamilton, generalized coordinates, oscillatory and cyclic motion and Newtonian potential theory.

Phys 541—ELECTRODYNAMICS—3 cr. (3 and 0)
This course starts with Maxwell's equations for electric and magnetic fields and includes consideration of production and propagation of electromagnetic waves, wave optics and theories of interference and diffraction.

Phys 542—RADIATION THEORY—3 cr. (3 and 0)
The production and propagation of electromagnetic waves are studied using Maxwell's equations as a starting point. Discussions of wave guides, diffraction phenomenon, and boundary effects are included. An introduction to the theory of electrons and microscopic phenomenon will be given.

Phys 551—INTRODUCTION TO QUANTUM MECHANICS—3 cr. (3 and 0)
An introductory course formulating the mathematical physical ideas associated with wave mechanics. Solution of simple physical systems including the hydrogen atom are discussed. **Prerequisites:** Phys 451 and Math 306.

Phys 552—THEORY OF ATOMIC SPECTRA—3 cr. (3 and 0)
A study of the excitation of spectra, computation of wave lengths from spectral photographs, the computation of energy levels and the correlation with theories of atomic structure.

Phys 553—NUCLEONICS—3 cr. (3 and 0)
This course is designed to give the basic properties of and the experimental methods employed in the study of particles associated with the nucleus. A survey is made of the theories so far advanced for the interaction of these particles and the theories pertaining to the structure of simple nuclei.

Phys 556—RELATIVITY—3 cr.(3 and 0)
This course is intended to give a survey of the special and general theory of relativity including tensor calculus, the Lorentz transformation and three experimental tests of the general theory: (1) planetary motion and the advance of the perihelion of Mercury (2) the bending of light rays in gravitational field and (3) the gravitational shift of spectral lines.

Phys 575—SEMINAR IN CONTEMPORARY PHYSICS—1 or 2 cr. (1 or 2 and 0)
A joint study by graduate students and interested members of the faculty of some area of physics which is currently being extensively investigated.

Phys 591—RESEARCH—3 cr.

Phys 592—RESEARCH—3 cr.

POULTRY

PH 352—POULTRY FEEDING AND FLOCK MANAGEMENT—3 cr. (2 and 3)

PH 354—POULTRY BREEDING—3 cr. (2 and 3)

PH 355—POULTRY GRADING AND PROCESSING—3 cr. (2 and 3)

PH 457—INCUBATION AND BROODING—3 cr. (2 and 3)

PH 458—POULTRY DISEASES AND PARASITES—3 cr. (2 and 3)

PH 460—SEMINAR—2 cr. (2 and 0)

RURAL SOCIOLOGY

RS 454—FARMERS' MOVEMENTS—3 cr. (3 and 0)

RS 459—THE RURAL COMMUNITY—3 cr. (3 and 0)

RS 461—RURAL LEADERSHIP—3 cr. (3 and 0)

RS 501—RURAL SOCIAL SYSTEMS—3 cr. (3 and 0)
A course designed to provide the advanced student with a brief review of the basic working concepts of rural sociology and a knowledge of the

basic institutions of rural life and to acquaint the student with the techniques used in applying scientific methods and theory toward understanding the social structure of rural life. **Prerequisites:** Permission of the instructor and 12 hours of social studies, at least three hours of which must be in the field of sociology.

TEXTILE CHEMISTRY

TC 410—COLOR MATCHING AND TESTING—1 cr. (0 and 3)

TC 447—THE CHEMICAL PROCESSING OF TEXTILE MATERIALS—3 cr. (3 and 0)

TC 449—TEXTILE CHEMISTRY LABORATORY—1 cr. (0 and 3)

TC 452—THE CHEMICAL PROCESSING OF TEXTILE MATERIALS—4 cr. (4 and 0)

TC 454—TEXTILE CHEMISTRY LABORATORY—1 cr. (0 and 3)

TC 455—CELLULOSE CHEMISTRY—3 cr. (3 and 0)

TC 456—CHEMISTRY OF SYNTHETIC FIBERS AND FINISHES—3 cr. (3 and 0)

TC 511—THE THEORY AND APPLICATION OF SYNTHETIC RESINOUS MATERIALS—3 cr. (2 and 3)

The aim of the course is to give the student a comprehensive survey of the history, present utility, and probable future expansion of synthetic resins. **Prerequisite:** TC 306 or Chem 222.

TC 512—THE THEORY AND APPLICATION OF SYNTHETIC RESINOUS MATERIALS—3 cr. (2 and 3)

A continuation of TC 511.

TC 521—ADVANCED CELLULOSE CHEMISTRY—3 cr. (3 and 0)

The purpose of the course is to present the chemistry of cellulose and closely related polysacchrides, through a systematic study of the extensive volume of research which has been completed on these substances. **Prerequisite:** TC 306 or Chem 222.

TC 531—CHEMISTRY OF COLORING MATTERS—3 cr. (2 and 3)

The work of this course consists of an advanced study of coloring bodies in their major forms, as dyes, pigments and lakes. Their structure and formulation for use is covered in detail with the chief emphasis being placed on the more complex forms, such as the vat colors and insoluble azo compounds. **Prerequisite:** TC 452.

TC 591—RESEARCH—3 cr.

TC 592—RESEARCH—3 cr.

TEXTILE MANAGEMENT

TM 403—TEXTILE MANAGEMENT—3 cr. (3 and 0)

TM 460—NATURAL FIBERS—3 cr. (3 and 0)

TM 462—TEXTILE MICROSCOPY—2 cr. (1 and 3)

TM 464—PHYSICAL TEXTILE TESTING—2 cr. (1 and 3)

ZOOLOGY

Zool 301—ADVANCED ZOOLOGY—3 cr. (2 and 3)

Zool 302—VERTEBRATE EMBRYOLOGY—3 cr. (2 and 3)

Zool 402—ANIMAL ANATOMY AND PHYSIOLOGY—3 cr. (2 and 3)

Zool 403—PROTOZOOLOGY—3 cr. (2 and 3)

Zool 456—PARASITOLOGY—3 cr. (2 and 3)

Zool 501—ADVANCED ANIMAL HISTOLOGY—3 cr. (2 and 3)
This is an advanced study in the microscopic structures of the tissues and organs of the animal body and the relation of histology to physiology and pathology. **Prerequisites:** Zool 101, 103, and 402.

Zool 502—HISTOLOGICAL TECHNIQUES—3 cr. (1 and 6)
The fixing, staining, sectioning, and identification of all tissues, glands and organs of animals. **Prerequisites:** Zool 101, 103.

Zool 503—ANIMAL ECOLOGY—4 cr. (2 and 6)
A comprehensive study of animals in relation to their natural environment. Typical animal habitats are visited to study the animal life and the ocean, shore, lakes, streams, swamps, cultivated fields, woodlands, and mountains.

Zool 504—ORNITHOLOGY—3 cr. (2 and 3)
The identification, life history and ecology of birds. Field trips, work with bird specimens and correlated reading will give the student a working knowledge of at least 100 species of the common birds.

Zool 505—PATHOGENIC DISEASES OF LIVESTOCK—3 cr. (3 and 0)
A graduate course designed to acquaint the student with the cause, prevention, and treatment of pathogenic diseases.

Zool 556—ECONOMIC ZOOLOGY—3 cr. (2 and 3)
A study of all phylla (exclusive of class insecta) to include those animals either beneficial or destructive to man. **Prerequisites:** Zool 101, 103.

Zool 591—RESEARCH—3 cr.

Zool 592—RESEARCH—3 cr.